Unit One: Force and Motion

Lesson 1

Motion in One Direction

Motion: It is the change of an object's location as time passes according to the location of another object.

There are two main types of motion:

a- Translational Motion (along a straight line).

b- Periodic Motion (along a curved path).

* Speed:

It is the distance covered by object in one second (per unit time).

OR: is change of distance with change time.

OR: is the rate of change of distance.

Unit: m/s or km/h.

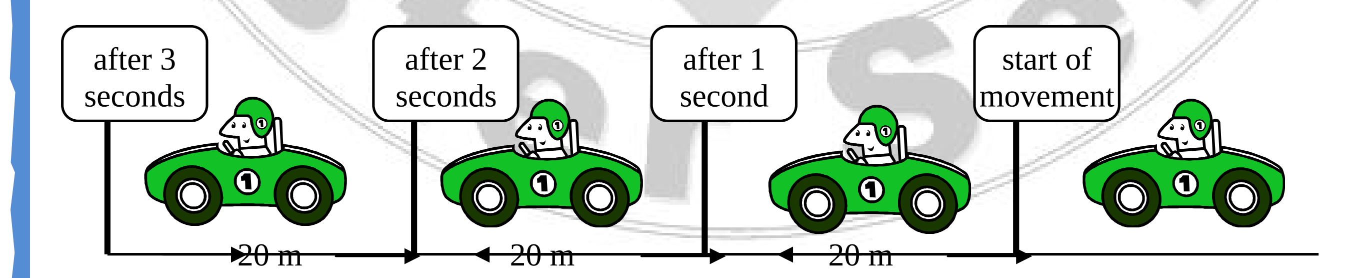
$$V = \frac{\Delta d}{\Delta t}$$

To convert Km/h to m/s (Multiply 5/18)

Types of speed:

1- Uniform (regular) speed:

The object covers equal distances at equal periods (interval) of time.



A car moved at a regular speed.

V = —— for regular speed only.

2- Non-uniform (variable) (Irregular) speed:

The object covers equal distances at unequal periods (interval) of time.

OR: The object covers unequal distances at equal periods (interval) of time.]

– Average speed ($\overline{V}$)

It is the total distance that a moving object covers divided by the total time taken to cover this distance.

Average distance: $\overline{V} = \frac{\mathbf{d\ (D)}}{\mathbf{time\ (T)}} = -$

* In case of moving at regular speed, the average speed equals the fixed uniform speed.

This means that $V = \overline{V}$ and this represents the regular motion.

* In case of moving at irregular speed, we calculate the average speed.

Relative Speed:

* If there is a person standing on the side of the road, and he observes the speed of the moving car (this person is called observer).

* Therefore measuring speeds depend on the position of the observer who determines the magnitude of this speed.

* This means that:

Relative speed: is the speed of moving object relative to the observer.

* We conclude that:

The value of the car's speed relative to the observer standing on the ground differs from the value of the car's speed relative to an observer in another moving car.

Home Work

I) Complete the following statements:

1. The..............is defined as the speed of moving object relative to the observer.

2. The total distance that a moving object covers divided by the total time taken to cover this distance is known as ....

3. The uniform speed of a car is 90 km/ hour so, its speed equals .... m/s.

4. When the average speed of an object equals the uniform speed in this case the motion represents .... motion.

5. The relative speed of moving object depends on ....

II) Write the scientific term:

1. The distance that a moving object covers within a unit time. [.......................]

2. The speed in which the object moves to cover equal distances at equal periods of time. [.......................]

3. The speed of moving object relative to the observer. [.......................]

4. The change in the position of a body by time relative to the position of another body. [.......................]

5. The simplest type of motion. [.......................]

III) Put (√) or (×) then correct what is wrong:

1. When a moving object covers equal distances at equal periods of time so it moves with uniform acceleration ( )

2. A car moves with regular speed covers 500 meters in 20 sec. its speed is 200m/s. ( )

3. Average speed is the speed of a moving object relative to the observer ( )

4. Measuring the relative speed for a moving car depends on the presence of speedometer, which determines the speed value. ( )

5. The relative speed of two moving bodies in the same direction equals the sum of their speed. ( )

IV) Give reasons for:

1. The moving car seems stable to an observer moves with the same speed and direction.

....

2. The uniform speed of a car can't be obtained practically.

....

3. The motion of the trains can be considered as a motion in one direction.

....

V) Define each of the following:

(1) Speed.

....

(2) Irregular speed.

....

(3) Average speed.

....

(4) Relative speed.

....

(5) Motion.

....

VI) Problem:

A runner covered a distance of 100 meters to the north in 30 seconds, then 50 meters to the east in 10 seconds, then 100 meters to the south in 15 seconds, and then he came back again to the starting point in 5 seconds. Calculate.

1. The total distance covered by the runner.

....

2. The average speed of the runner.

....

Lesson 2

Graphic Representation of Moving in Straight Line

***Acceleration:** is the speed of object in one second (per unit time).

OR: is change of speed with change time. OR: is the rate of change of speed.

Note: *If body moves from rest $V_1 = 0$ a body stops $V_2 = 0$*

$$\text{*Acceleration (a)} = \frac{(\Delta V)}{\text{Time } (\Delta t) \text{ in}}$$

$$\text{Acceleration (a)} = \frac{\text{Final speed } (V_2) - \text{speed}(V_1)}{(\Delta t)}$$

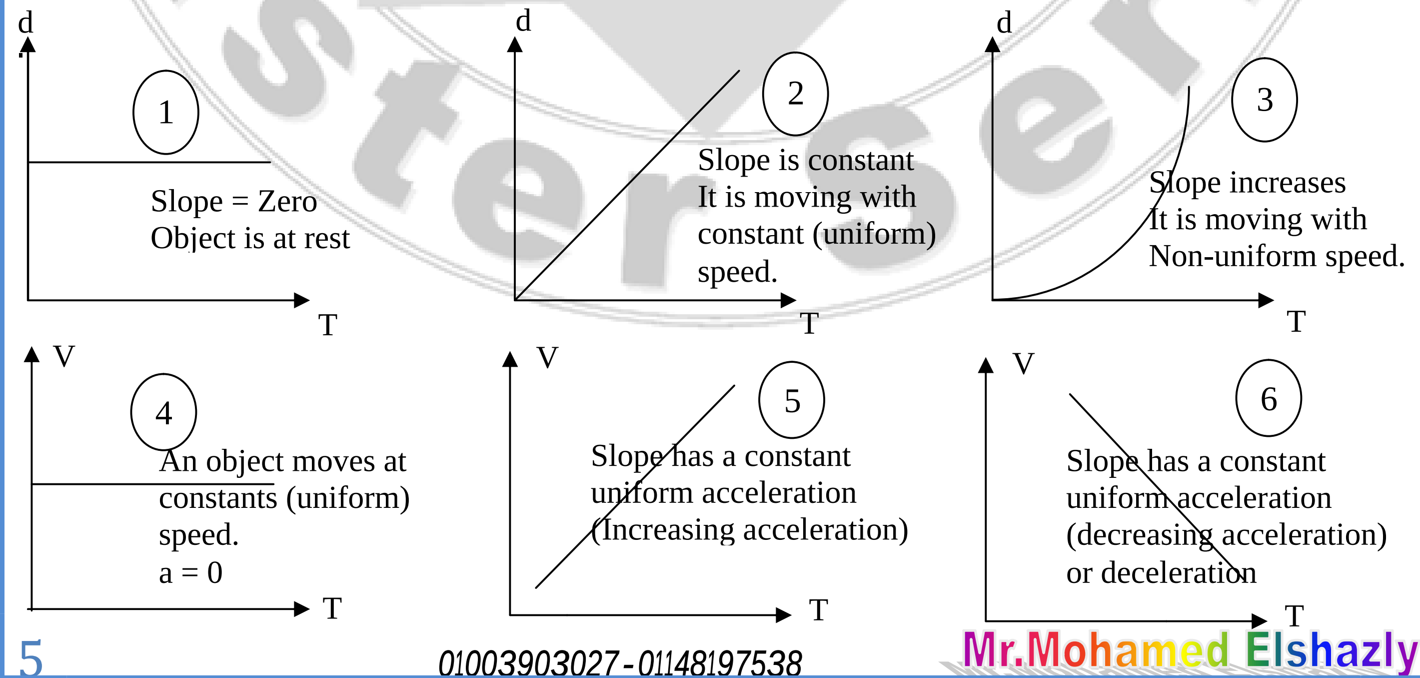
$$\text{* Acceleration units} = \frac{\text{Speed}}{\text{Time}} = \frac{m/s}{} = m/s^2$$

Types of acceleration:

Uniform acceleration: It is acceleration of object when moves by equal speeds in equal periods of time. (Increasing and decreasing acceleration).

- Increasing acceleration whene ($V_2 > V_1$)
- Decreasing acceleration whene ($V_2 < V_1$)
- a = 0 whene uniform speed ($V_2 = V_1$)

* Graphics can possibly represent the relation between distance or speed on x-axis and time in a moving car on y-axis.



Home Work

I) Complete:

1. The value of change of an object's speed in one second is ....

2. When an object moves with decelerating motion this means that it's .... speed is greater than its ....speed.

3. For a car moves with regular speed, the ratio d / t is ....

4. The ratio between the final speed and initial speed for an object moves with accelerating motion is ....one.

II) Write the scientific term:

1. The graph for a regular motion at uniform speed that is represented by a straight line parallel to the (×) axis. [.............................]

2. The change of the object's speed by equal values through equal periods of time. [.............................]

3. The graph for a regular motion at uniform speed which is represented by a straight line passes through – the origin point. [.............................]

III) What's the difference between:

1. Speed – acceleration (Definition – measuring unit)

....

2. The graphical relation (distance – time) and the graphical relation (speed – time) for regular motion in a straight line at constant speed.

....

IV) Problems:

1- A racing car starts moving from the rest. Then its speed increased to 900 m/s through 5 second. Calculate the acceleration of the moving car.

....

2- A car moves at speed100 km / h if the driver reduces its speed by a rate of 2km / h^2.Calculate the car's speed after half hour.

Lesson 3

Physical quantities: (Scalars and Vectors)

1- Physical quantities are classified into two types:

Points	Scalar physical quantity	Vector physical quantity
Definition	It has a magnitude only.	It has a magnitude & direction.
Examples:	Mass (kg), length& distance (m), time(s), speed (m/s).	Force (Newton), acceleration & gravitational acceleration (m/s^2) displacement (m),velocity (m/s).

2- Distance and displacement:

Points	Distance	Displacement
Definition	It is the actual (real) path between two positions.	The length of the shortest straight line between two positions. OR: distance in a constant direction.
Scalar or vector	Scalar quantity, which has a magnitude only.	Vector which has a magnitude & direction.
Example	Distance (d) = AB + BC.	Displacement (d) = $\overrightarrow{AC}$.
Unit	Meter.	Meter.

A, B, C

3- Speed and velocity:

North
West
East
South

Points	Speed	Velocity
Definition	Distance covered by object in one second.	Displacement covered by object in one second.
Type	Scalar.	Vector.
Units	m/s or Km/h	
Law	$\text{velocity} = \frac{\text{Distance}}{\text{Time}}$	$\text{velocity} = \frac{\text{Displacement}}{\text{Time}}$

Home Work

I) Complete the following:

1. The ………….. is a vector quantity while …………..is a scalar quantity.

2. ……………… is the distance in a constant direction and is a vector quantity.

3. Average velocity =……………..

II) What's the difference between :

- Distance and displacement (Definition only).

……

- Scalar quantity and vector quantity (Definition and Examples).

……

III) What is meant by?

1. The displacement of an object is 60 meters in east direction.

……

2. The average velocity of a moving car is 80 km / h.

……

IV) When dose the following cases happen:

1. The displacement covered by a moving body equals zero.

……

2. The distance and displacement of a moving object are equal.

……

V) Problems:

1. A tennis ball falls from a height of 30 m. then it rebounds from the ground to upward a distance of 6 m. find the distance covered by the ball and the displacement .

……

2. If a body starts its motion from point (a) covered 20 meters northward till point (b) within 20 seconds, then 50meters eastward till point (c) within 10 seconds then 20 meters southward till point (d) within 5 seconds calculate the average velocity .

……

……

3. A body moves in a circular path, starting from the point A to B to C to D and returns back to the start point (A) if the circumference of the path is 200 meters and the body covered the distance (ABC) within 10 seconds. Then it covered the distance (CDA) within 20seconds calculate:

1) The total distance the body moved.

………………………………………………………………………………

2) The average speed of the body.

………………………………………………………………………………

3) The displacement.

………………………………………………………………………………

4) The average velocity of the body.

………………………………………………………………………………

VI) Give reasons for:

1. Velocity and acceleration are vector quantities. While distance and length are scalar quantities.

………………………………………………………………………………

2. Pilots take in consideration the velocity of the wind.

………………………………………………………………………………

VII) Write the scientific term:

1. The length of shortest straight line between primary position and final position. [……………………]

2. The rate of change of displacement. [……………………]

3. The vector quantity, which is measured in m/s^2. [……………………]

Technology of Unit (1)

1- The predator (cheetah) is one of the fastest animals as it is possible that its speed reaches 27 m/s.

2- If the sun is 149000,000 kilometers away from the Earth and if the speed of light is 300,000 Km/s,

To calculate the time that light takes to reach from the sun to the Earth.

Time = $\frac{\textbf{Total distance moved}}{\textbf{Light speed}} = \frac{\textbf{149000000}}{\textbf{300000}}$ = 496.67s = 8.3 minutes.

3- Plane flies in the reverse direction of the wind.

1- Increase wind resistance.

2- Increase compensation of fuel.

3- Increase time taken to complete trip.

Ø Pilots take into consideration the directing velocity of the wind. (G.R)

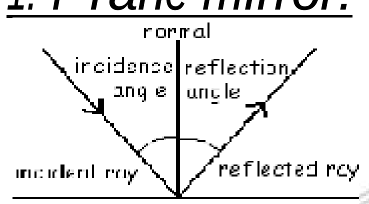
- To calculate the amount of fuel necessary to complete the trip.

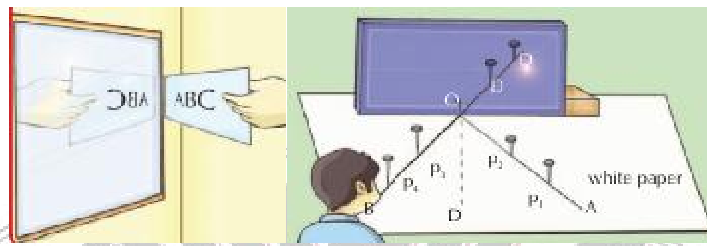
4- Speedometer:

It is a device used to detect the speed of car or plane.

Unit Two: Light Energy
Lesson 1: Mirrors

1. Plane mirror:







Light reflection: It is rebounding (bouncing) light ray in same direction when meeting reflecting surface.
The incident ray: The light ray falls on the reflecting surface.
The reflected ray: The light ray bounces from the reflecting surface.
Angle of incidence: The angle between the incident ray and normal.
Angle of reflection: The angle between the reflected ray and normal.

-Laws of light reflection:

1st law: the angle of incidence = the angle of reflection.

2nd law: The incident light ray, the reflected ray and the norm to the reflecting surface lie in the same plane.

The properties of an image formed by a plane mirror:
1. Upright.
2. Reversed (lateral inverted).
3. Equal in size to the object.
4. Virtual (can't be received on a screen).
5. The distance between the object & the mirror = the distance between the image & the mirror.

- (G.R): The word «ambulance» is writing laterally inverted.
Bec. Mirror forms lateral inverted image So, driver can see word corrected.

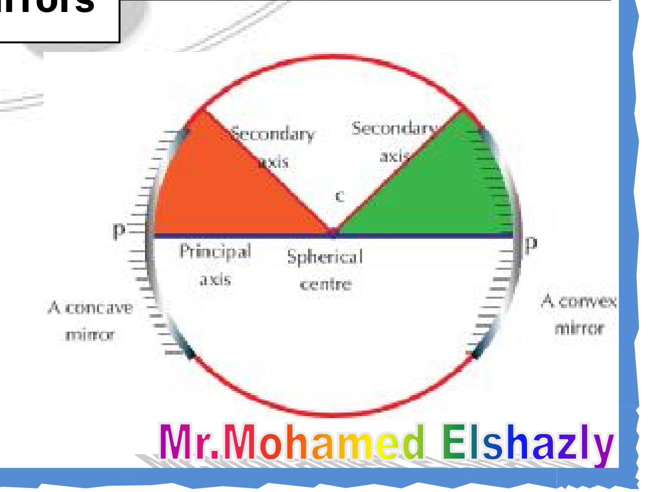
2. Types of spherical mirrors

The concave (converging) mirror:

The reflecting surface is the inner surface of the sphere.

The convex (diverging) mirror:

The reflecting surface is the outer surface of the sphere.



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Definitions:

1. Centre of curvature(C):

The center of the sphere that the mirror is a part of it.

2. Radius of curvature:

The radius of the sphere that the mirror is a part of it.

3. The pole (P):

The point in the middle of the reflecting surface of the mirror.

4. The principle axis (CP):

The straight line that passes through the center of curvature (C) and the pole (P).

5. The secondary axis:

The line that passes through the center of curvature (C) and any point on the surface of the mirror except the pole (P).

6. The focus (F):

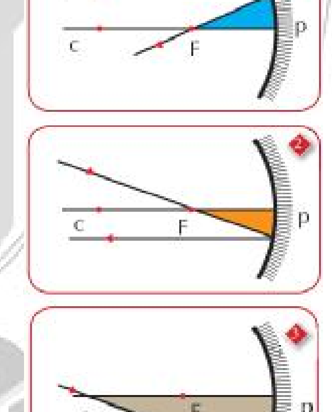
The point of collection (intersection) of the reflected rays (when these rays fall parallel to the principle axis).

7. The focal length (FP):

The distance between the focus & the pole.

The focal length = ½ the radius of the curvature

- To study the cases of the formation of the images by the spherical mirrors, we will use three rules for light rays meeting concave mirror:



1- The light ray parallel to the principal axis of the mirror. This is reflected through Focus (f).

2- The light ray through focus (F) will reflect parallel to the principal axis.

3- The light ray through centre of curvature of the mirror (c). This is reflected back through (c).

The path of light reflected from a spherical mirror

Position of the object	Position of the images	Characteristics of the images	The cases of image formation
At a distance larger than the radius of curvature.	Between the focus and the centre of curvature	Real – inverted – small in the object	p f C The image The object

At the centre of curvature of the mirror.	At the centre of curvature of the mirror.	Real – inverted. Same size as object	
Between c and (f).	At a distance greater than the radius of curvature.	Real - inverted larger than object	
Between (f) and (p).	Behind the mirror	Virtual upright magnified	

Uses of concave mirror:

-Used in solar ovens to collect sun rays & generate heat that cook food without fuel.

Uses of convex mirrors:

-The real view mirror in the car & side view mirrors is convex mirrors (G.R).

-To expand the visibility because it formed virtual, small & erect image.

Determine half the radius of the concave mirror.

The materials:

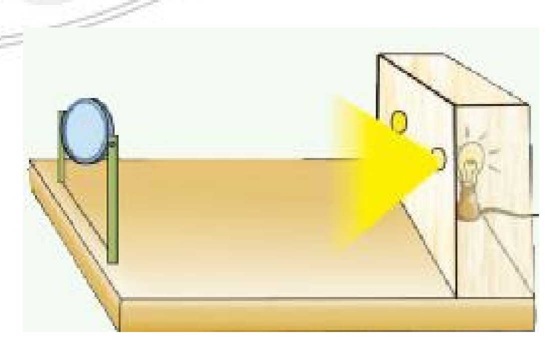
A concave mirror – a holder for the mirror – light box with a hole.

The steps:

1- Place the mirror on a holder in front of the light source (lit hole).

2- Move the mirror nearer and farther until an image of the hole is formed next to it and is equal to it.

3- Measure the distance between the mirror and the hole, it is equal to the radius of curvature of the mirror.



Deduce:

The focal length of the mirror (f) = R/2

Home Work

I) Write the scientific term:

1. The rebounding of light to the same side when it strikes a reflecting surface.

2. The angle between the incident light ray and the perpendicular line on the reflecting surface. [..............................]

3. Angle of incidence = Angle of reflection. [..............................]

4. The point of collection of parallel light rays to the principal axis of the concave mirror. [..............................]

5. Twice the focal length of a spherical mirror. [..............................]

II) Put (√) or (×) and correct the false ones:

1. The distance between the object and a plane mirror is more than the distance between the plane mirror and the image. ( )

2. When the angle between the incident ray and the plane mirror surface is 60º, so the angle of reflection is 50º. ( )

3. The formed image for a body put in front of a convex mirror is virtual, inverted and small. ( )

4. A spherical mirror of diameter equals 14 cm, its focal length is 6 cm. ( )

5. The focus is the point that is in the middle of the reflective surface of the mirror. ( )

III) Give reasons for:

1. Concave mirror is used in cooking by using solar energy.

2. A convex mirror is put at the left side of the driver of a car.

3. The incident light ray falling perpendicular on a reflecting surface reflects on itself.

4. The word AMBULANCE is written in a converted way on the ambulance car.

IV) Show by drawing the path, the direction of rays and properties of image in the following cases:

- An object in front of a concave mirror at a distance less than its focal length.

- The image that is formed by the convex mirror.

- An object in front of a concave mirror at a distance equal to its focal length.

- An object in front of a concave mirror at a distance of 7 cm. Knowing that its focal length is 5 cm.

V) An object is put at a distance 20 cm from a mirror the image is formed on a screen and has a length equal to the object.

(1) What is the type of the mirror?

....

(2) Calculate the focal length of the mirror.

....

(3) Draw the path rays that show the formation of this image.

....

....

Lesson 2: Lenses

- **Lens:**

It is a transparent medium (glass or plastic) which has two spherical surfaces (faces) or (consists of two mirrors) and refract light.

- **The uses of lenses:**

a. medical eyeglasses.
b. magnifying lenses are used to fix watches.
c. In telescope that study planets.
d. In microscopes.

- **Types of lenses:**

Concave lens	Convex lens
1. It is thin at its centre and more thickness at the tips. 2. Diverges (scatters) light rays. 3. It has a virtual focus.	1. It is thick at the centre and less thickness at the tips. 2. Converges (collects) light rays. 3. It has a real focus.
The principal axis, C_2, P, C_1	The principal axis, C_2, P, C_1

- **Definitions:**

1. The centre of curvature of the lens face (c): Is the centre of the sphere where this face is a part of it.

2. The optical centre of the lens (p): Is a point inside the lens placed on the principal axis in the mid distance between its faces.

3. The radius of curvature of the face of the lens (r): Is the radius of the sphere where the face is a part of it.

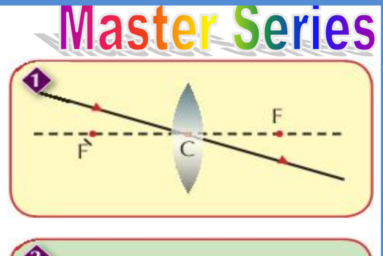
4. The principal axis: Is the line between the centers of curvature of the lens passing by the optical center.

5. Real Focus (f): Is the intersection of refracted light rays. $f = r/2$

6. Virtual Focus (f): Is the intersection of extension of refracted light rays.

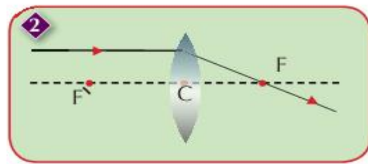
7. Focal length (FP): Is the distance between focus and optical center.

<u>*The cases of the formation of the images by the convex lens (collective):*</u>



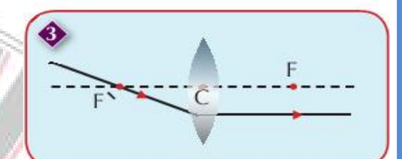
1. If ray falls by optical center thus complete in its direction without any refraction.

2. If ray falls parallel to the principal axis thus refracts passing through the focus.

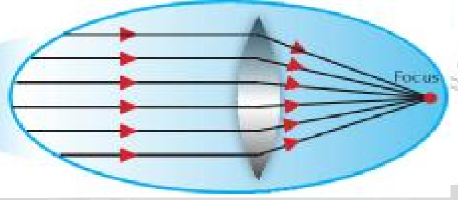




3. If ray falls by the focus thus refracts parallel to the principal axis.





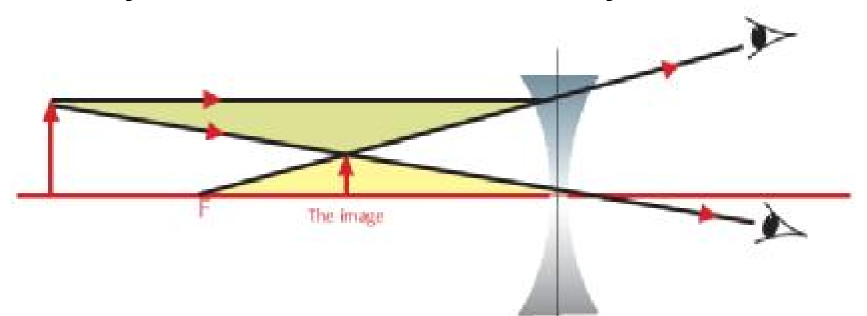


r = 2f

<u>*The images formed by the convex lens:*</u>

Position of the body	Position of the image	Characteristics of the image	Case of image formation
More than twice the focal length	Between the focus and twice the focal length	Real, inverted, and smaller the object	The object, C, F, F, C, The image
At twice the focal length	At twice the focal length	Real, inverted and equal to the object	The object, The image, C, F, C, The image
Between the focus and twice the focal length	At a distance larger than twice the focal length	Real, inverted and enlarged	The object, C, F, F, C, The image
At the focus	No image is formed	No image is formed	The object, F The image, The image, F
At a distance smaller than the focal length	Forms in front of the lens at the object side	Virtual, upright and enlarged	The image, F, F

The image formed by a concave lens is always: virtual, small & erect



Vision Defects:

The person with normal vision sees the far object clearly (the far object according the normal eye is present at 6m). This clear vision remains if the object comes closer not less than 25 cm.

Short sightedness	Long sightedness
1. The Person can see near objects clearly and far objects seem distorted.	The person can see far objects clearly and can't see near objects.
2. The image of far objects is formed in front of the retina.	The image of near objects is formed behind the retina.
3. What causes it? a. The diameter of the eyeball is too long. b. The eye lens more convex. c. Decreasing the focal length.	What causes it? a. The diameter of the eyeball is too short. d. The eye lens less convex. b. Increasing the focal length.
4. It is treated (corrected) by using Concave lens (diverging lens).	It is treated (corrected) by using convex lens.

Contact lens: It is very thin lenses made of plastic, and can stick to the eye cornea by the eye fluid instead of medical glasses.

Technology of Unit (2)

1- Land measurement:

Land surveyors and topographical scientists use a mirror to determine heights and distances and to make very accurate measurements.

2- According to the old Greek legend that Archimedes knew a lot about mirrors and the use of sunlight as a weapon against the Roman fleet in 212 B.C. he used a huge concave mirror to collect the sun rays and directed towards the sails of ships so as to generate extreme heat that led to the burning of these sails.

3- Cataract:

Is one of the most dangerous diseases that injure the eye lens and becomes dark as a result of old age, illness, and side effects of drugs in addition to genetic readiness.
Treatment is done through surgery to exchange the eye lens with a plastic lens.

Home Work

I) Complete the following statements:

1. A point inside the lens placed on the principal axis in the mid distance between its faces is ....
2. The radius of the convex lens = ...Its focal length.
3. The long sighted person needs a medical eye glasses with ....Lenses .
4. The optical piece that forms an equal, inverted image of the body is the............

II) Write the scientific term:

1. The line joining between the two centers of curvature of the lens and passing through the optical center.
2. A vision defect results due to the formation of the image in front of retina.
3. The lenses that are used instead of glasses and can stick to the eye cornea.
4. A disease infects the eye lens, so it becomes dark.

III) Give reasons for:

1. The convex lens has two foci, but the concave mirror has one focus.

………………………………………………………………………………………………

2. The short – sightedness is treated by using a concave lens.

………………………………………………………………………………………………

3. It's impossible to obtain a real image by using a concave lens.

………………………………………………………………………………………………

4. The convex lens is called converging lens while the concave lens is called diverging lens.

………………………………………………………………………………………………

IV) What happens when?

1. A light ray is incident parallel to the principal axis of the convex lens.

………………………………………………………………………………………………

2. The eye lens is too convex.

………………………………………………………………………………………………

3. A light ray passes through the optical center of the lens.

………………………………………………………………………………………………

V) Define each of the following:

1. The lens.
2. The center of curvature of the lens face.
3. Short sight defect.

VI) Problems:

1. A concave lens has a focal length equals 3 cm. An object is placed at a distance of 4 cm. From the lens, determine the position of the formed image and its properties by drawing the light rays.

2. A convex lens. Its focal length equals 5 cm. An object is placed at a distance 7 cm from the lens, Determine the position of the formed image and its properties by drawing only two light rays.

3. Mention the position and properties of the image formed of an object is put at a distance less than the focal length.

4. A convex lens with focal length of 20 cm an object was placed at a distance of 40 cm from the lens. Assign the distance of object's image from the lens and mention its properties.

Technology of Unit (1&2)

Unit (1)

1- The predator (cheetah) is one of the fastest animals as it is possible that its speed reaches 27 m/s.

2- If the sun is 149000,000 kilometers away from the Earth and if the speed of light is 300,000 Km/s,
To calculate the time that light takes to reach from the sun to the Earth.

Time = ____________ = ________ = 496.67s = 8.3 minutes.

3- Plane flies in the reverse direction of the wind.

1- Increase wind resistance.
2- Increase compensation of fuel.
3- Increase time taken to complete trip.

Ø Pilots take into consideration the directing velocity of the wind. (G.R)

- To calculate the amount of fuel necessary to complete the trip.

4- Speedometer:

It is a device used to detect the speed of car or plane.

Unit (2)

1- Land measurement:

Land surveyors and topographical scientists use a mirror to determine heights and distances and to make very accurate measurements.

2- According to the old Greek legend that Archimedes knew a lot about mirrors and the use of sunlight as a weapon against the Roman fleet in 212 B.C. he used a huge concave mirror to collect the sun rays and directed towards the sails of ships so as to generate extreme heat that led to the burning of these sails.

3- Cataract:

Is one of the most dangerous diseases that injure the eye lens and becomes dark as a result of old age, illness, and side effects of drugs in addition to genetic readiness.
Treatment is done through surgery to exchange the eye lens with a plastic lens.

Unit (3)

Lesson (1): The Universe

The Universe:

It is the wide space that contains all galaxies, stars, sun, planets, moons, living organisms, and everything.

The Galaxies:

They are groups of stars that rotate together in cosmic space by the effect of gravity. OR, They are biggest units of universe.

-Galaxy has a distinctive shape according to the harmony and order of the groups of stars in it.

Galaxies Clusters:

They are groups of galaxies in the space.

The Milky Way galaxy (Our Galaxy):

It contains the sun and the solar system.

-Milky Way galaxy is given that name (G.R), Bec. It in the sky at night as a splashing milk or spreading straw.

The Solar System:

It is the sun and eight planets revolving around it.

1. The Solar system is located in one of the spiral arms of the Milky Way galaxy on the edge of the galaxy.
2. The Sun takes about 220 million years to complete one rotation around the center of the galaxy.

The Earth:

It is the planet of life.

Light Year:

Bec. The distance between stars very large.

It is the distance covered by light in one year.

-Speed of light = 300,000 km/s, light year = 9.467×10^{12} km.

-Distance by Km = Distance by light year x 9.467×10^{12} Km.

The Big Bang Theory:

The Big Bang:

It is a massive explosion since 15000 million years ago which resulted in all forms of matter, energy, space and time.

Expansion of universe:

It is the continuous separation between galaxies.

OR, Galaxies move away from each other in the cosmic space (Universe).

Time starting after The Big Bang	Events
Since 15000 million years.	The process of expansion of the gaseous ball component, which has very high pressure and temperature.
Through 1 second after explosion	The temperature decreased to about 10,000 million degrees.
Within minutes after the Big Bang:	The atomic particles produced from explosion producing gaseous clouds of hydrogen 75% and helium 25%.
1000 million years after the Big Bang:	The gaseous clouds formed homogenous masses, which produced matter of galaxies.
2000:3000 m years after the Big Bang:	Ancestral galaxies were evolved.
3000 million years after the Big Bang:	Galaxies began to form.
5000 million years after the Big Bang:	The Milky Way galaxy took its disc form.
10,000 million years after the Big Bang:	The Sun was born then the Earth and planets were created.
12,000 million years after the Big bang:	Earliest life forms began to appear on the Earth.
15,000 million years after the Big bang:	The universe as it is now.

The Origin Of The Universe

In ancient civilizations:

Their belief that their relationship with the world of multiple gods and there is a fundamental difference between the earth and heaven.

In the Stone Age:

Through Myths which dominated the human imagination.

Ancient Egyptians and Babylonians:

Assumed that there was a relationship between the eternal universe and the multiple Gods controlling it.

At both the Indian and Chinese civilizations:

Astrology prevailed.

Philosophers of Greeks and Romans: Put theories about cosmic phenomena.

Two theories explain what is going to happen to the universe.

The open theory

The universe will keep expanding endlessly.

The closed theory

The universe will eventually stop expanding then it will contract until it becomes so compact & hot & then a new big bang might

(2) Solar System

The solar system consists of :

-The sun, 8 planets that revolve around the sun.

The sun is the dominant star in this system as it represents more than 99% of its total mass.

-Moons (The satellites of the planets), which revolve around planets, Asteroids, Comets.

-The solar system extends 12 billion km in space.

-The solar system was formed 4600 million years ago.

The recent theory of solar system evolution:

-The sun was surrounded by a sphere of gas (a mixture of hydrogen and helium) and dust (iron, rocks and ice) called the solar nebula.

-Later on, it turned into a flat rotating disk, and then the dust compressed forming inner four masses: Mercury, Venus, the Earth and Mars. In an external further zone, dust and ice combined with gases forming Jupiter, Saturn, Uranus and Neptune.

- A solar nebula It is a cloud of gas and dust surrounding sun in space.

The Universal Law of Gravitation (Newton's gravitational law):

The attraction force between two bodies in the Universe is directly proportional to the product of their masses & inversely proportional to the square of the distance between them.

Central gravitational force:

It is the force that keeps the continuity of the planets rotating in their orbits around the Sun.

Theories about the evolution of the solar system:

1- Nebular assumption by Laplace: (as rings surrounding Saturn).

1. There was a nebula (a glowing gaseous sphere revolved around itself).
2. Over the time, the nebula gradually lost its heat so its size contracted and its revolving speed around itself increased.
3. Due to centrifugal force resulting during rotation caused the nebula to change its shape into a flat rotating disk.
4. The centrifugal force also caused the separation of parts of the nebula.
5. These parts kept rotating in the same direction of the original nebula then they cooled & solidified & frozen were formed planets revolving around sun.

2- The crossing star theory by Chamberlain & Molten:

1. At the beginning, another huge star approached the sun.
2. The part of the sun facing the other star expanded.
3. This led to a huge explosion in the sun which formed a gaseous line of a great length & covering a large distance in space.
4. The explosion caused the sun to move away from the other star.
5. The gaseous line cooled & condensed due to attraction forces forming planets.

The modern theory of the world by Alfred Hale:

The theory is based on the following observations:

a. A star glows for a short time & its glow exceeds any other star in the sky.

b. A day or two later the excess glow produced by this star is reduced & the star glow as usual. (G.R):

The reason for that glow is unknown but may be due to the explosion of the star as a result of nuclear reactions that occur suddenly and violently that the star bombs huge amounts of gaseous materials.

3- The modern theory of the world assumption by Alfred Hale:

1- The existence of a star rotating near the sun.

2- The star was exposed to explosion due to huge nuclear reactions.

3- The force of the explosion led to the bombing of the star's nucleus away from the gravity of the sun.

4- A cloud of gas remained and was subject to cooling and contraction processes forming planets.

5- The force of the sun's attraction controlled the orbits of planets around it.

A day and year on each of the planets:

- A day: is the time taken by a planet to rotate around its axis (itself).
- Earths day: is the time taken by the Earth to rotate around itself.
- Q: A day on each planet has a different length because planets different in:
  a. their radius and their speed around their axis.
- The year: is time taken by a planet to rotate around the sun.
- Earths year: is time taken by the Earth to rotate around the sun.
- Q: A year on each planet has a different length because planets different in:
  a. their distance between them and sun and their speed around sun.
- Mercury has the shortest year = 0.24 Earths year. Because it is the nearest planet to sun.
- Jupiter has the shortest day = 0.41 Earths day.

- **v** Neptune has the longest year = 165 Earths year. Because it is the furthest planet from sun.
- **v** Venus has the longest day = 243 Earths day.

Technology and Society

1. The solar telescope:

Place: It is centered on the Earth or carried to space.

Use: It forms a picture of the Sun.

This telescope is used to collect the sunlight, and then separated into solar spectrum by the spectrometer.

Astronomers got most of their information about the Sun from the study of its spectra.

2. Telescopes:

Telescopes rotating in orbits around the Earth are better than that are been on the surface of the Earth because:

They can see celestial bodies more clearly.

They catch rays that can't be able to penetrate the Earth's atmosphere.

Example: The Hubble telescope:

It rotates around the Earth at a height of 500km.

It collects photos for the universe since millions of years; these photos give astronomers an opportunity to study the evolution of the universe after the Big Bang.

3. Spacecraft:

They revolve around other planets or land on them sending discoveries to the Earth.

4. Space suit:

The first astronauts wore one space suit for the trip. Today, they wear two space suit, one to travel back and forth and another inside the spacecraft.

5. Weightlessness:

The continuous force of the Earth's gravity on our bodies gives us weight. But, when you are inside a lift going downward fast, you feel that you are lighter in weight.

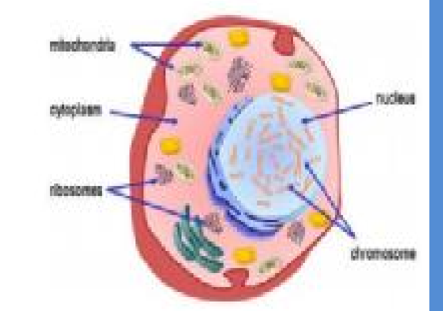
This phenomenon occurs in the spacecraft as astronauts fall down inside it with the same speed.

Unit Four: Reproduction and Species Continuity

Lesson One: Cell Division

Our body and the bodies of all multi-cellular living organisms contain two kinds of cells which are:

1. **Somatic cells:** All body cells except reproductive cells.
   1. The cells of [liver – skin – kidney – ...] ➔ in humans and animals.
   2. The cells of [roots – stem – leaves – ...] ➔ in the plant.
2. **Reproductive cells which are:**
   1. Testis and ovary cells ➔ in humans and animals.
   2. Anther and ovary cells. ➔ in flowering plants.

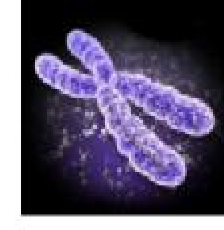


N.B.: The nucleus is responsible for cell division, because it contains the genetic material of the living organism which consists of a number of **chromosomes** that have the main role in cell division.

Chromosomes

Chromosomes:
They are thread like bodies present in cell's nuclei and they represent the genetic material of the living organism.

General structure of chromosomes:
It consists of:



1. **Chromatids:**
   They are two connected threads.
2. **Centromere:**
   It is the point of connection of the two chromatids of chromosome during the cell division.

Chemical structure:
Each chromatid consists of:

1. **DNA:**
   It is the nuclei acid that forms the chromosomes that present in the cell nucleus and it carries the genes.

The Cell —Contains→ **Nucleus** —Contains→ **Chromosomes** —Carry→ **Genes**

2. **Protein.**

Information about chromosomes:
The number of chromosomes in living organisms is:

1. Different from a species to another.
2. Fixed in members of the same species.
3. Somatic cells contain two sets of chromosomes [one inherited from the father and the other from the mother].
4. The number of chromosomes in **somatic cells** is a **diploid number [2N]**, while in **gametes** [male gametes (sperms) and female gametes (ova) is a **haploid number (N)**].
5. Knowing the number of chromosomes helps in identifying the animal and plant species.
6. In human, all **somatic cells** contain **46** chromosomes, while the **gametes** contain **23** chromosomes.

Cell division

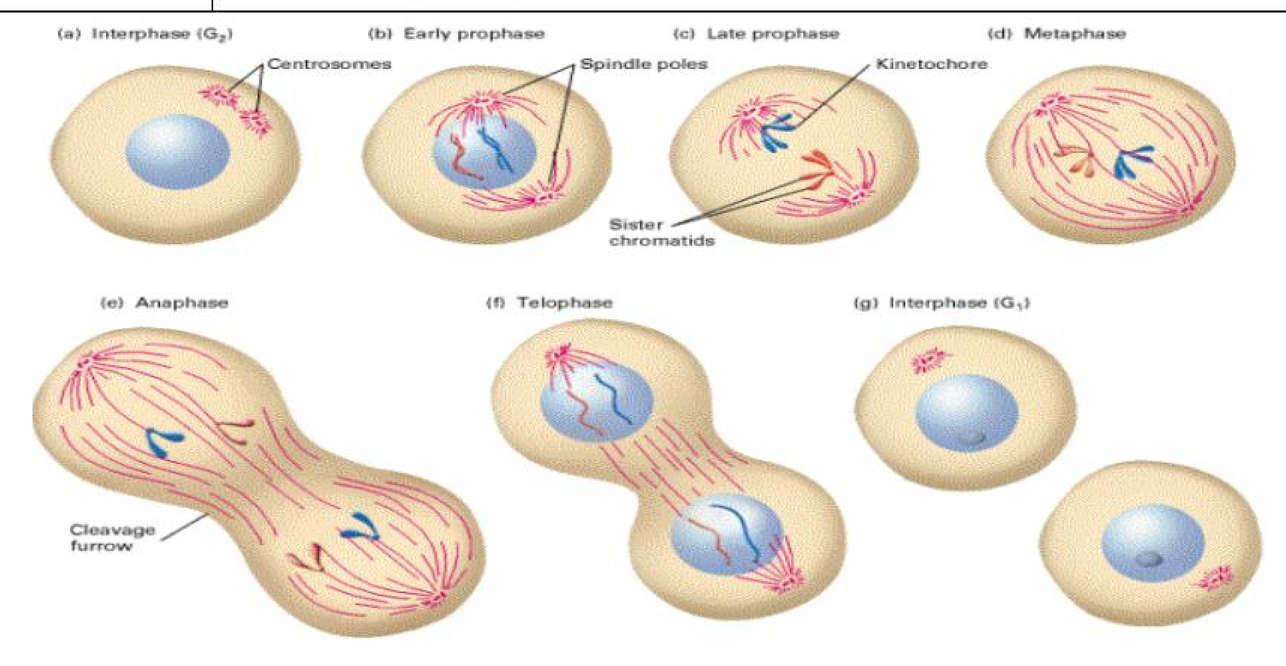
Cell division:

It is a complicated process through which the living cell divides into two cells or more to aim the growth or reproduction.

Types of cell division

Mitosis. **Meiosis.**

P.O.C.	Mitosis (Mitotic division) Indirect cell division
Location:	It takes place in somatic cells.
Importance:	1- Growth of living organisms. 2- Compensation of damaged cells. 3- Completing the asexual reproduction process.
Resulting cells:	Two cells, each cell contains the same number of chromosomes (2N) of the parent cell.
Interphase:	**During interphase:** 1- The cell prepares for division. 2- The amount of genetic material (DNA) duplicates.
Stages of division:	One stage including four phases which are: [Prophase – Metaphase – Anaphase – Telophase].
Prophase:	**Prophase:** 1- Chromatin reticulum condenses to form chromosomes. 2- Spindle is formed extending between the two poles of the cell. 3- The nucleolus and nuclear membrane disappear.
Mesophase:	The chromosomes which are connected with the spindle fibers are arranged along the cell equator.
Anaphase:	1- The centromere of each chromosome splits lengthwise into two halves, so the chromatids separate from each other. 2- Spindle fibers begin to shrink and two identical groups of chromosomes (each contains single chromatid) are formed. Each group of chromosomes migrates towards one of the cell's poles.
Telophase:	1- The spindle fibers disappear. 2- A nuclear membrane is formed at each pole of the cell surrounding by the chromosomes leading to formation of two nuclei. 3- The cell divides into two new cells **(2N).**



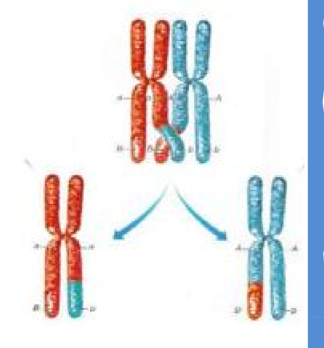
N.B:

1. In **animal** cell, the **spindle fibers** are formed by the **centrosome**.
2. In **plant** cell, the **spindle fibers** are formed from **condensing the cytoplasm** at the cell poles.
3. **G.R.:** The changes occur in Telophase are called the **adverse changes**.
   Because they inverse the changes occur in prophase from division.
4. Some cells in the human body are not divided at all such as **nerve cells** and **red blood cells**.
5. Some cells such as liver cells are not divided in normal conditions but they retain the ability to divide under certain circumstances [**Liver transplantation**].

P.O.C.	Meiosis (Meiotic cell division) Reduction division
Location:	It takes place in reproductive cells [gonads].
Importance:	Formation of gamete. In males ➔ sperms or pollen grains. In females ➔ ova or ovules.
Resulting cells:	Four cells, each contains half number of chromosomes (N) of the parent cell.
Interphase:	**During interphase:** 1- The cell prepares for division. 2- The amount of genetic material (DNA) duplicates.
Stages of division:	**Two stages:** 1- First meiotic division. 2- Second meiotic division.
Prophase I:	**Prophase I:** 1- Chromatin reticulum condenses to form chromosomes. 2- Chromosomes are arranged in **homologous** pairs, each pair consists of 4 chromatids [**Tetrad**]. 3- Crossing over phenomenon occurs. 4- The nucleolus and nuclear membrane disappear. 5- Each two homologous chromosomes move away from each other. 6- The spindle fibers appear and connect to chromosomes at centromere.
Mesophase I:	The chromosomes which are connected with the spindle fibers are arranged along the cell equator.
Anaphase I:	1- The spindle fibers shrink, so every two homologous chromosomes move away from each other. 2- One of the two chromosomes migrates towards the cell pole and the other migrates towards the other pole. 3- Each pole contains half the number of chromosomes of the parent cell.
Telophase I:	1- The spindle fibers disappear. 2- A nuclear membrane is formed at each pole of the cell surrounding by the chromosomes leading to formation of two nuclei. 3- The cell divides into two new cells **(N).**

The crossing over phenomenon:

It is a phenomenon that takes place at the end of prophase I and in which some parts of the two inner chromatids of each tetrad are exchanged to produce new genetic arrangements.



Importance of the crossing over phenomenon:

It works on the variation of genetic traits among the members of the same species.

Second meiotic division:

It aims to increase the number of the produced cells from the first meiotic division.

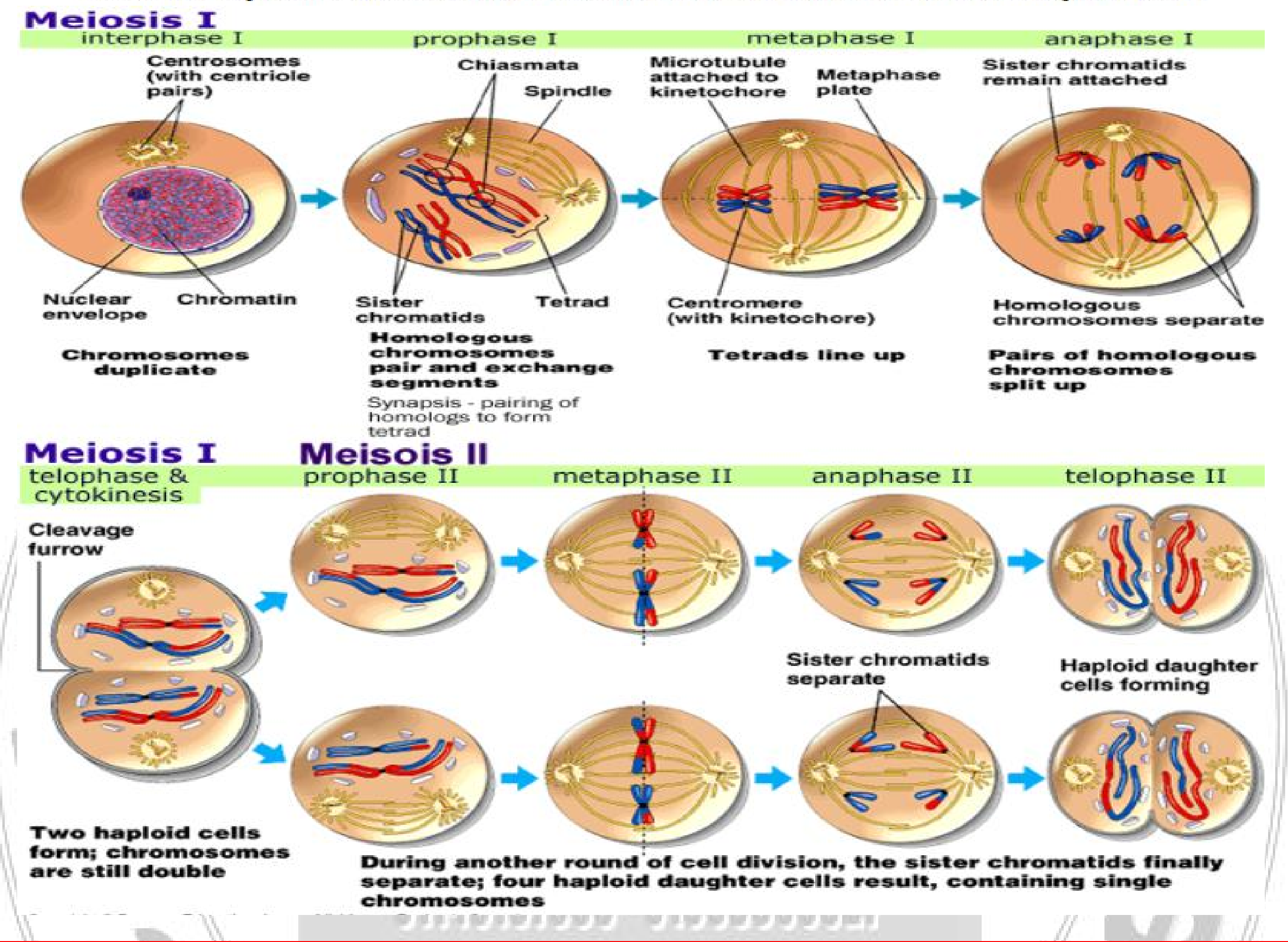
Phases of the second meiotic division:

Prophase II – Metaphase II – Anaphase II – Telophase II.

Which are similar to mitotic cell division.

G.R.: Meiotic cell division is called by reduction division.

Because the produced cells contain half the number of chromosomes of the parent cell.



Nanotechnology and cancer treatment

Cancer occurs when the body cells are divided continuously without controlling.

Discovering cancer disease: By using Nano-technical as follows:

1. This technic starts by loading proteins with Nano-molecules of gold and then injecting them into the patient.
2. The golden molecules pass through the blood of the patient, then proteins attach on the cancerous cell surface to monitor it through a microscope, each cell separately.

Treatment of cancer:

1. **By using Nano-molecules of gold as follows:**
Focusing laser with a certain degree to the gold molecules, then the gold molecules absorb the light and convert it into heat which burn and kill the infected cell.
2. **By using developed microscopic bombs:**
   1. Using Nanotechnology, scientists have developed smart microscopic bombs that penetrate the cancer cells and explode them from inside.
   2. They were used to kill the cancer cells in experimental mice. Mice suffered from cancer were able to live 300 days after this treatment. As for mice that did not receive treatment, they did not live more than 43 days.

Unit Four: Reproduction and Species Continuity

Lesson One: Sexual and Asexual Reproduction

Reproduction process:

It is a biological process, where the living organism produces new individuals of the same kind and thus, ensuring its continuity.

Types of reproduction:

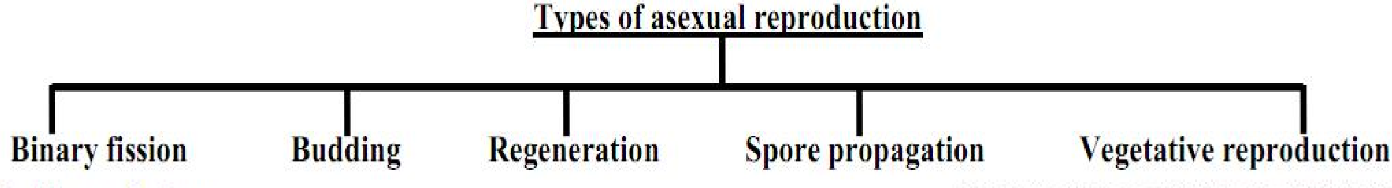
1. Asexual reproduction.
2. Sexual reproduction.

Asexual reproduction:

It is a process by which living organisms produce new individuals with genetic traits identical to those of their parents.

G.R.: Asexual reproduction needs no special systems and structures to occur.

Because it takes place by **mitosis** division.



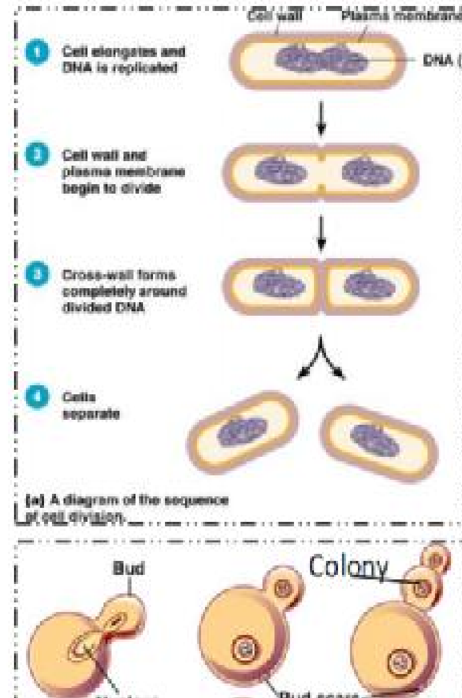
1. Binary fission:

It occurs in unicellular living organisms:

1. Unicellular protozoans [**Amoeba** – **Paramecium** - **Euglena**].
2. Simple algae and bacteria.

How does the reproduction by binary fission occur?

1. The nucleus divides by **mitosis division** and the cell splits into two cells.
2. Each cell grows and becomes a new individual.



2. Budding:

It is a sexual reproduction produces new individuals by formation of buds in the parent cell.

It occurs in:

1. Unicellular organisms [As **Yeast fungus**].
2. Multicellular organisms [As **Hydra** and **Sponges**].

How does the reproduction by budding occur in yeast fungus?

1. A bud emerges as a lateral bulge in the cell.
2. The cell nucleus divides mitotically into 2 nuclei [One in the mother cell and the other moves to the bud].
3. The bud grows gradually, then it separates from it.
4. If the buds remain connected to the parent cell, **colony** is formed.

3. Regeneration:

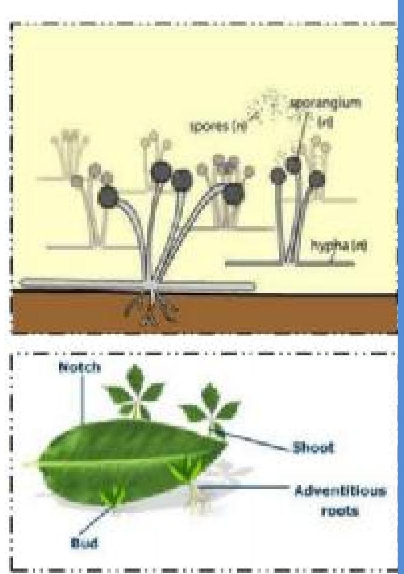


It is the ability of animals to compensate their missing parts.

How starfish can reproduce?

Starfish arm could be regenerated and give out a complete animal if they contain a part of the **central disc** of the animal.

4. Sporogony (Spore propagation):



It occurs in:

1. Some fungi such as **bread mould** and **mushrooms**.
2. Some **algae**.

How does the reproduction by spore propagation occur?

1. Each sporangium rupture and a large number of spores are released.
2. When spores are scattered on a suitable environment, they grow to give new organisms [**Fungi**]

5. Vegetative reproduction:

It is an asexual reproduction by using vegetative organs except seeds.

1. It occurs **without the need** of seeds, but by **the plant vegetative organs** [leaves – roots – stems] in order to produce new plants identical to the parent plant.
2. It also occurs by plant cells in **tissue culturing**.

Sexual reproduction:

It is a process by which living organism produces individuals with traits differ from parents.

It depends on two main processes:

1. Gametes formation.

1. Gametes of male and female are formed in the reproductive cells by the **meiotic** division.
2. Gametes contain **half** the chromosomes number (**N**).

2. Fertilization.

It is the combination of a male gamete (N) and a female gamete (N) to form a zygote (2N) which contains the normal number of chromosomes of the organism.

Zygote:

It is a cell produced due to fertilization and it contains the complete number of chromosomes of the living organism.

Sexual Reproduction	Asexual reproduction
It occurs by two living organisms, one of them is a male and the other is a female.	It occurs by one living organism.
It occurs in higher living organisms of plants and animals.	It mostly occurs in single-celled living organisms.
It depends on meiotic division.	It depends on mitotic division.
The new offspring combines the genetic traits from two sources [The male and female].	The new offspring gets a full copy of the parent individual's genetic traits.

G.R.: Sexual reproduction is a source of the genetic variation from parents to children.

Because offspring resulted from sexual reproduction gets his genetic traits from two sources, the male and the female.